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ABSTRACT

The mathematical skills possessed by students taking introductory biology courses were investigated. A list of 23 mathematical competencies was identified as part of the development of a 46-item multiple-choice test to measure the extent to which students possessed these competencies. The Biomathematics Skills Test (BST) was administered to students in introductory biology courses for science majors (BS-100) and nonmajors (BS-105). Although 804 students took the pretest, only 354 took the posttest. The relationships between the mathematical skills possessed by students at the beginning of the semester (measured by the BST) and 15 variables dealing with selected student characteristics were examined. Among the findings are those indicating that: males did significantly better than females in the BS-100 pretest but there were no significant sex differences in the case of BS-105; whites did significantly better than blacks on the pretest in both courses; and taking or not taking a mathematics or statistics course was not related to BST performance. BST scores and high school grade point average were found to be predictors of success in both courses. Scholastic Aptitude Test mathematics and verbal scores and age were also found to predict success in BS-100. These and other findings support the conclusion that the BST measures the mathematical skills needed in introductory college biology courses. (Author/JN)

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An Assessment of the Quantitative Skills of Students Taking Introductory College Biology Courses

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ABSTRACT

An Assessment of the Quantitative Skills of
Students Taking Introductory College Biology Courses

The mathematical skills possessed by students taking introductory college biology courses were investigated. A list of 23 mathematical competencies were identified as part of the development of a 46-item multiple choice test to measure the extent to which students possessed these competencies. The Biomathematics Skills Test (BST) was administered at the beginning and end of the 1983 fall semester to students in introductory biology courses for science majors (BS 100) and non-science majors (BS 105) at North Carolina State University. Eight hundred and four students took the pretest, but only 354 took the posttest. The overall average for the pretest was 70% for BS 100 students and 65% for BS 105 students.

The relationships between the mathematical skills possessed by students at the beginning of the semester as shown by the BST pretest and 15 variables dealing with selected student characteristics were examined. There were significantly positive correlations for 12 of 15 variables in the case of BS 100 pretest scores and 11 in the case of BS 105. Males did significantly better on the pretest than females in the case of BS 100, but there were no significant differences in the case of BS 105. Whites did significantly better on the pretest than blacks in both courses. The means for a combined group of Hispanics, Indians, and Asians were not significantly different than whites, but were higher

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than blacks in BS 100.

The type of biology course (BS 100 or BS 105) taken was found to be significantly related to BST performance. The variable of taking or not taking a mathematics or statistics course during the semester was not significantly related to BST performance.

The BST pretest and seven other variables were used to determine the best predictors of success for the two biology courses. SAT-Mathematics, SAT-Verbal, High School Grade Point Average, Age, and BST pretest were significantly predictors of success in BS 100. BS 105 predictors were High School Grade Point Average and BST pretest.

AN ASSESSMENT OF THE QUANTITATIVE SKILLS OF STUDENTS TAKING INTRODUCTORY COLLEGE BIOLOGY COURSES

Biology traditionally has been viewed as a descriptive subject requiring little mathematical skill. But as biology has matured as a science, it has become more quantitative in nature. Educators hold that it is important that introductory courses reflect the current status of the biological sciences if students are to gain an accurate view of the discipline. Also, students being prepared for careers in biology must develop the mathematical competencies that are becoming increasingly important in the discipline.

Purpose of the Study

The main purposes of the study were to answer the following questions:

1. To what extent do students possess the mathematical skills desired of students taking an introductory college biology course?
2. What relationships exist between the mathematical skills possessed by students at the beginning of the course and certain selected variables?
3. How do the mathematical skills of students taking an introductory biology course change over the course of the semester?
4. Which independent variables are the best predictors of success in introductory college biology courses?

Procedures

A list of 23 competencies recommended by the Royal Society-Institute of Biology's Working Party for Mathematics in Biology (1975) was identified as part of the literature review. As one means of judging the appropriateness of this list for the United States, the list was compared with the mathematics section of the Competency Goals and Performance Indicators for North Carolina (1977). A composite list of 23 competencies resulted, which were designated as the Mathematical Competencies for Biology.

Sixty-nine test items were constructed, with three items corresponding to each competency. Four forms, each containing 25 questions, were pilot tested using students in BS 100 (an introductory college biology course for science majors at North Carolina State University) during the fall of 1982. The results of this pilot were used to select the best two items corresponding to each competency.

The competencies and accompanying test items were sent to a panel of judges who are Advanced Placement Biology Readers and who also teach introductory college biology courses. The jury was asked to judge the desirability of each competency and the representativeness of the corresponding items. All competencies and corresponding test items were found acceptable by the judges; however, several suggestions were made for minor revisions in their wording. The final decision about the two items used to represent each competency was made using the responses of the jurors and an analysis of the pilot test results.

The Biomathematics Skills Test (BST) was administered as a pretest and posttest during the fall semester of 1983 to students enrolled in BS 100 and BS 105 (introductory college biology course for non-science majors) at North Carolina State University. Eight hundred and four students took the pretest, but only 354 students took the posttest. The population consisted of mainly freshmen.

Results

Out of 46 items on the BST pretest, the BS 100 students averaged about 32 correct responses and BS 105 students averaged about 30. Males did significantly better than females on the BST in the case of BS 100 and insignificantly higher in the case of BS 105. An analysis of variance indicated that whites and a combined group of Hispanics, Asians, and Indians in BS 100 did significantly better than blacks on the BST pretest; whites made significantly higher scores than blacks in the case of BS 105. Out of 15 variables, there were 12 significantly positive correlations between the variables and the BST pretest scores of BS 100 students (SAT-Verbal, SAT-Mathematics, Predicted Grade in English, Predicted Grade in Mathematics, High School Grade Point Average, University Predicted Grade Average, high school rank, the algebra and trigonometry parts of the North Carolina State University mathematics placement test, and vocabulary, reading comprehension, and reading rate parts of the Nelson-Denny reading test). The BS 105 group had 11 significantly positive correlations between the BST pretest scores and 11

variables (same as the BS 100 list with the exception of the reading rate part of the Nelson-Denny reading test).

BS 100 students had significantly higher scores than BS 105 students on the BST pretest, posttest, and in terms of BST gain scores. An analysis of covariance showed that the BST pretest as covariate and the independent variable of biology course (BS 100 or BS 105) taken significantly affected BST posttest performance, but the independent variable of taking or not taking a mathematics or statistics course did not affect posttest results.

In determining multiple regression equations, the final grade in BS 100 and BS 105 served as the dependent variables and eight selected variables served as independent variables. The significant variables in a multiple regression equation for BS 100 were SAT-Verbal, SAT-Mathematics, Age, High School Grade Point Average, and BST pretest. High School Grade Point Average and BST pretest were the only significant variables in the multiple regression equation for BS 105.

Conclusions and Implications

The findings of this study support the conclusion that the Biomathematics Skills Test (BST) measures the mathematical skills needed in introductory college biology courses. The test results were found to correlate well with measures of mathematical ability and scholastic aptitude, as well as being useful in predicting success in the biology courses. The BST and the list of Mathematical Competencies for Biology on which the test is based should be useful to biology educators as they move to make biology courses more quantitative.

References

Mathematics Division (1977). Competency Goals and Performance Indicators for North Carolina. North Carolina State Department of Public Instruction.

Royal Society - Institute of Biological Education Committee (1975). Report of the Working Party on Mathematics for Biologists. International Journal of Mathematical Education in Science and Technology, 6(1), 123-135.